

Table 33

**SUITABILITY OF SOILS FOR ONSITE SEWAGE  
DISPOSAL SYSTEMS IN WAUKESHA COUNTY**

Classification	Conventional Systems		Mound Systems	
	Square Miles	Percent of Land Area	Square Miles	Percent of Land Area
Suitable	143.0	25.8	273.8	49.3
Unsuitable	247.4	44.6	188.0	33.9
Undetermined	151.6	27.3	80.2	14.5
Unclassified	13.0	2.3	13.0	2.3
Total Land <sup>a</sup>	555.0	100.0	555.0	100.0

<sup>a</sup>Does not include 25.6 square miles of surface water in the County.

Source: SEWRPC.

about 49 percent of the total land area of the County, is covered by soils considered suitable for mound onsite sewage disposal systems. Of the remainder, 188 square miles, or 34 percent, is covered by soils classified as unsuitable; 80 square miles, or 15 percent, is covered by soils classified as undetermined; and 13 square miles, or 2 percent, is denoted as unclassified.

**Suitability for Agriculture:** In order to lend uniformity to the identification of productive farmlands throughout the nation, the U. S. Department of Agriculture, Soil Conservation Service, established a soil classification system under which soils are categorized relative to their agricultural productivity. The two most highly productive soils are categorized as either National prime farmland or as farmland of statewide significance. National prime farmland is defined as land that is well suited for the production of food, feed, forage, fiber, and oilseed crops, with the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when properly treated and managed. Farmland of statewide importance includes land in addition to national prime farmland which is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

As indicated on Map 17, approximately half of the land in Waukesha County is covered by soils that are well suited for agricultural use, classified as either National prime farmland or farmland of statewide importance. Approximately 211 square miles, or 38 percent of the total land area of the County, is covered by soils designated as national prime farmland; 61 square miles, or 11 percent, is covered by soils designated as farmland of statewide importance.

Although careful consideration must be given to a number of factors other than soils in the identification of prime farmlands, soil suitability is one of the most important of these factors. Other factors which shall be considered in the identification of prime farmlands are addressed in Chapter IV of this report.

**Suitability for Extraction of Minerals:** Waukesha County has an abundant supply of sand, gravel, and stone. The soils around and in the Kettle Moraine are the most likely source areas for sand and gravel. In this area, the melting waters of the glacier were most active in sorting and depositing high-quality sand and gravel as kames, eskers, and outwash terraces. Ground moraine, common in other parts of the County, typically has not been sorted, as has the glacial outwash, and is generally not as well suited for commercial sand and gravel. Potential sand and gravel deposit areas, as shown on Map 18, comprise 210 square miles, or 38 percent of the total land area of the County. These areas are concentrated in the western half of the County along the Kettle Moraine and on outwash plains, although many other small deposits are also scattered throughout the remainder of the County.

The Waukesha County soils most commonly suitable for supplying sand and gravel are the Adrian, Boyer, Casco, Drummer, Fabius, Fox, Gilford, Granby, Kane, Lorenzo, Matherton, Mussey, Osh-temo, Rodman, St. Charles, Sebewa, Virgil, Warsaw, and Wasepi series, all underlain by glacial outwash. The deposits are extremely variable; thus onsite investigations are usually necessary to determine the suitability of each site for a specific purpose.

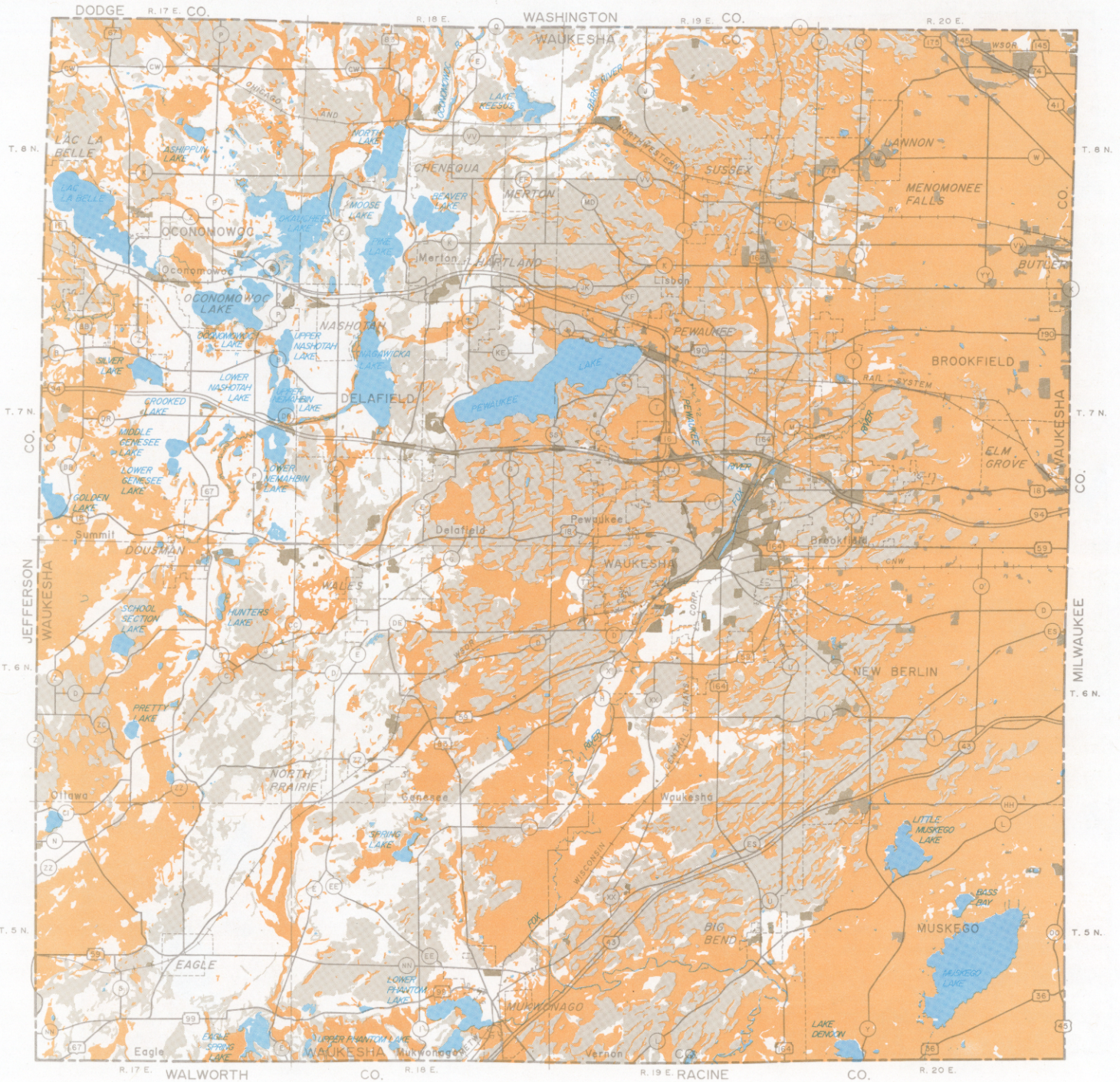
Soils with depth to bedrock of two feet or less in Waukesha County are shown on Map 19, and indicate areas most suitable for quarrying stone. These soils cover approximately 8.3 square miles, or 1.5 percent of the total land area of the County. As indicated previously, the largest areas are concentrated near the Villages of Lannon and Sussex, with some smaller areas in other parts of the County. The soils most likely to overlie dolomite bedrock at shallow depths are the Knowles, Pella (shallow variant), and Ritchey series.

## GROUNDWATER RESOURCES

Except for a 52-acre parcel of land located in U. S. Public Land Survey Township 8 North, Range 20 East, Section 25, in the City of Milwaukee, Wauke-

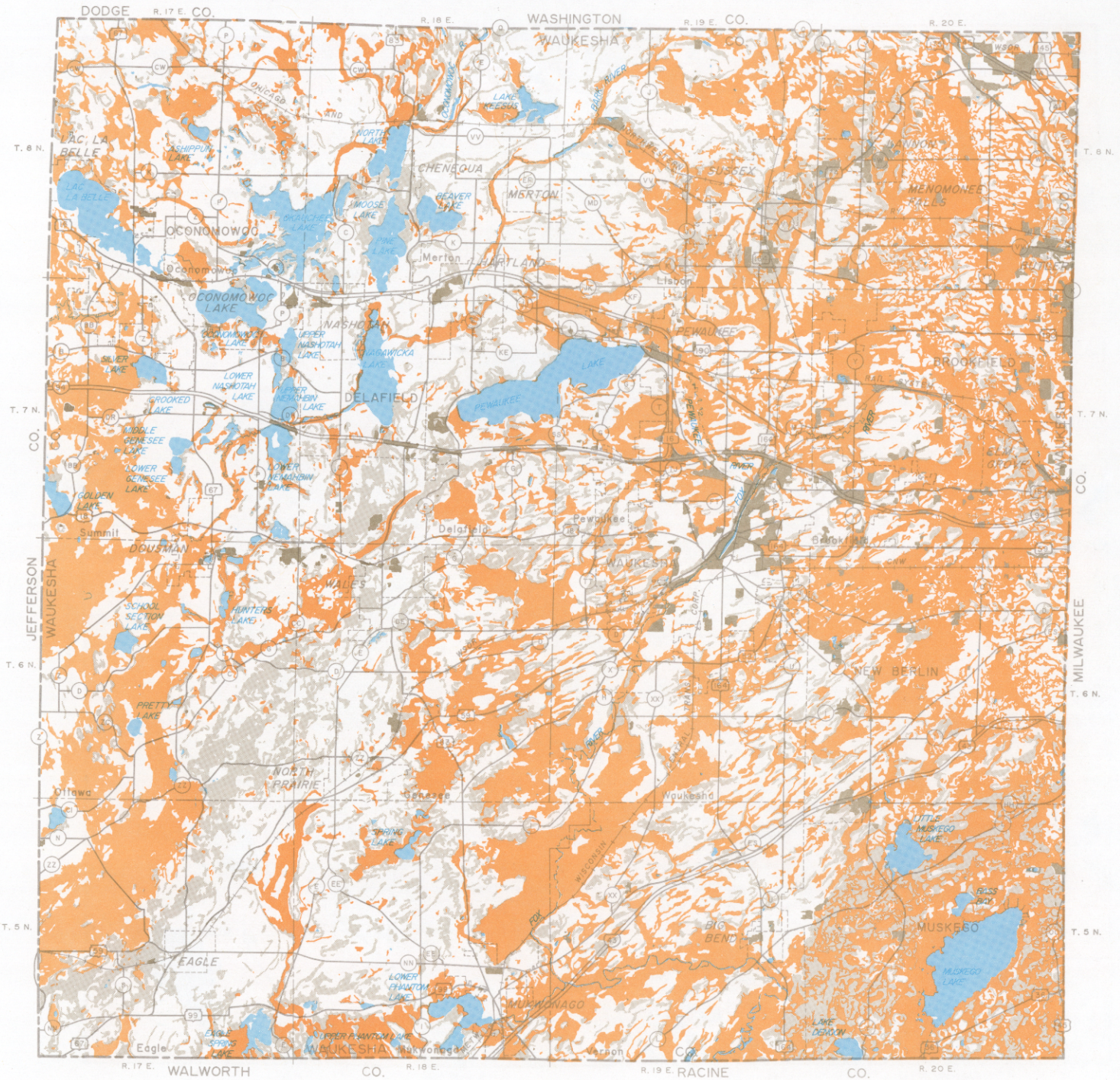


**SUITABILITY OF SOILS FOR CONVENTIONAL ONSITE SEWAGE DISPOSAL SYSTEMS  
IN WAUKESHA COUNTY UNDER CURRENT ADMINISTRATIVE RULES: FEBRUARY 1991**





**SUITABILITY OF SOILS FOR MOUND SEWAGE DISPOSAL SYSTEMS IN  
WAUKESHA COUNTY UNDER CURRENT ADMINISTRATIVE RULES: FEBRUARY 1991**



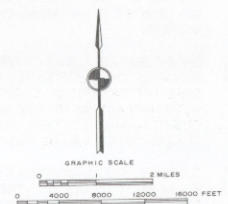
**LEGEND**

- UNSUITABLE: AREAS COVERED BY SOILS HAVING A HIGH PROBABILITY OF NOT MEETING THE CRITERIA OF CHAPTER ILHR 83 OF THE WISCONSIN ADMINISTRATIVE CODE GOVERNING MOUND SEWAGE DISPOSAL SYSTEMS
- UNDETERMINED: AREAS COVERED BY SOILS HAVING A RANGE OF CHARACTERISTICS AND/OR SLOPES WHICH SPAN THE CRITERIA OF CHAPTER ILHR 83 OF THE WISCONSIN ADMINISTRATIVE CODE GOVERNING MOUND SEWAGE DISPOSAL SYSTEMS SO THAT NO CLASSIFICATION CAN BE ASSIGNED
- SUITABLE: AREAS COVERED BY SOILS HAVING A HIGH PROBABILITY OF MEETING THE CRITERIA OF CHAPTER ILHR 83 OF THE WISCONSIN ADMINISTRATIVE CODE GOVERNING MOUND SEWAGE DISPOSAL SYSTEMS

- OTHER: AREAS CONSISTING FOR THE MOST PART OF DISTURBED LAND FOR WHICH NO INTERPRETIVE DATA ARE AVAILABLE

- SURFACE WATER

NOTE: ONSITE INVESTIGATIONS ARE ESSENTIAL TO THE DETERMINATION OF WHETHER ANY SPECIFIC TRACT OF LAND IS SUITABLE FOR DEVELOPMENT SERVED BY A MOUND SEWAGE DISPOSAL SYSTEM

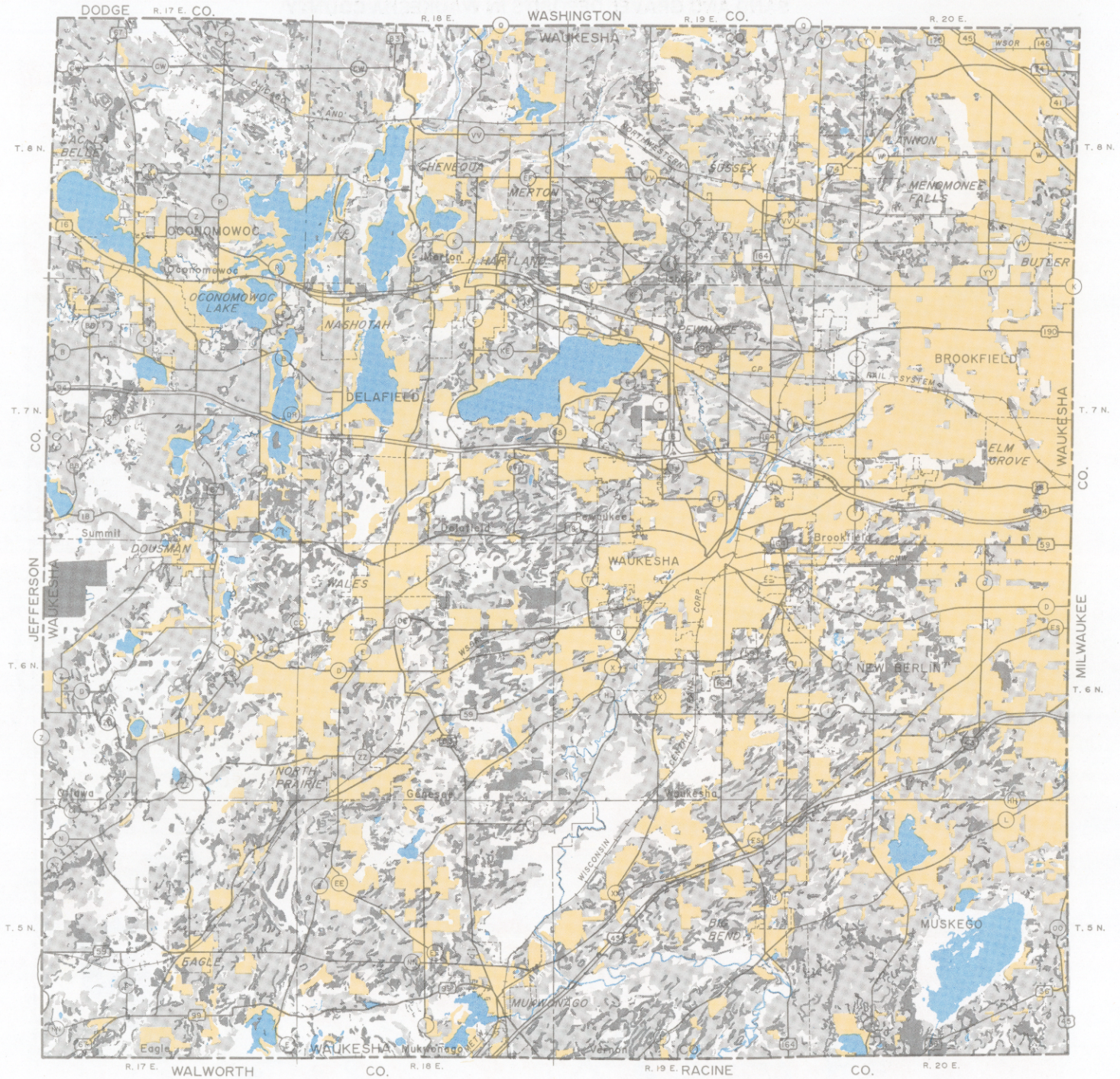


Source: U. S. Soil Conservation Service and SEWRPC.



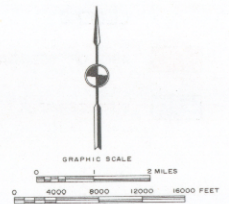
Map 17

AGRICULTURAL SOIL CAPABILITY IN WAUKESHA COUNTY



LEGEND

- NATIONAL PRIME FARMLAND
- FARMLAND OF STATEWIDE IMPORTANCE
- DEVELOPED URBAN AREA: 1990
- SURFACE WATER

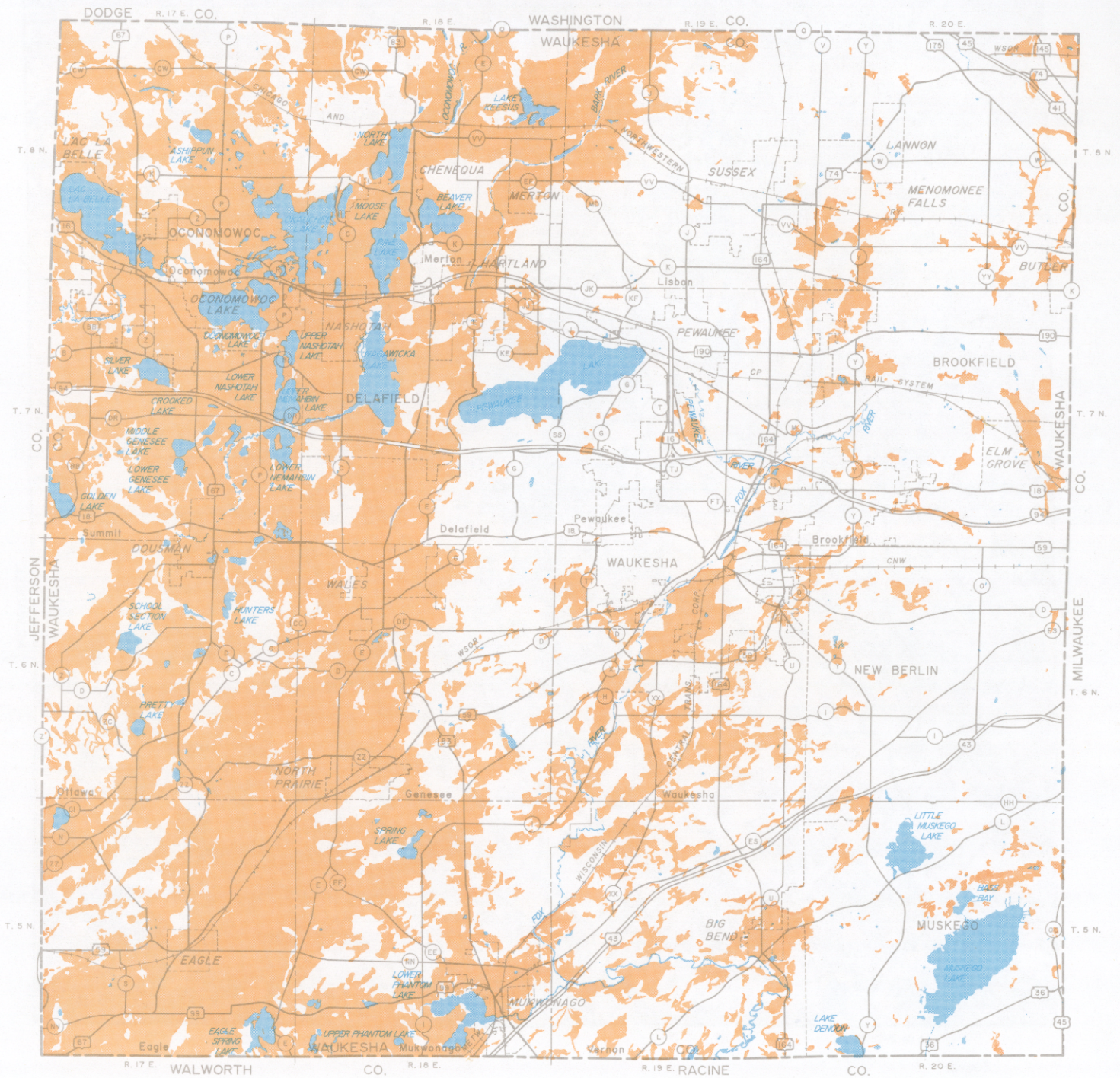


Source: U. S. Soil Conservation Service and SEWRPC.



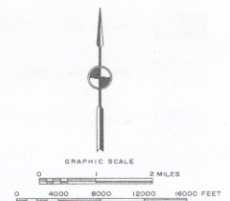
# Map 18

## AREAS WHERE SOIL SURVEY DATA INDICATE POTENTIAL SAND AND GRAVEL DEPOSITS IN WAUKESHA COUNTY



### LEGEND

- AREA OF POTENTIAL SAND AND GRAVEL DEPOSIT
- SURFACE WATER

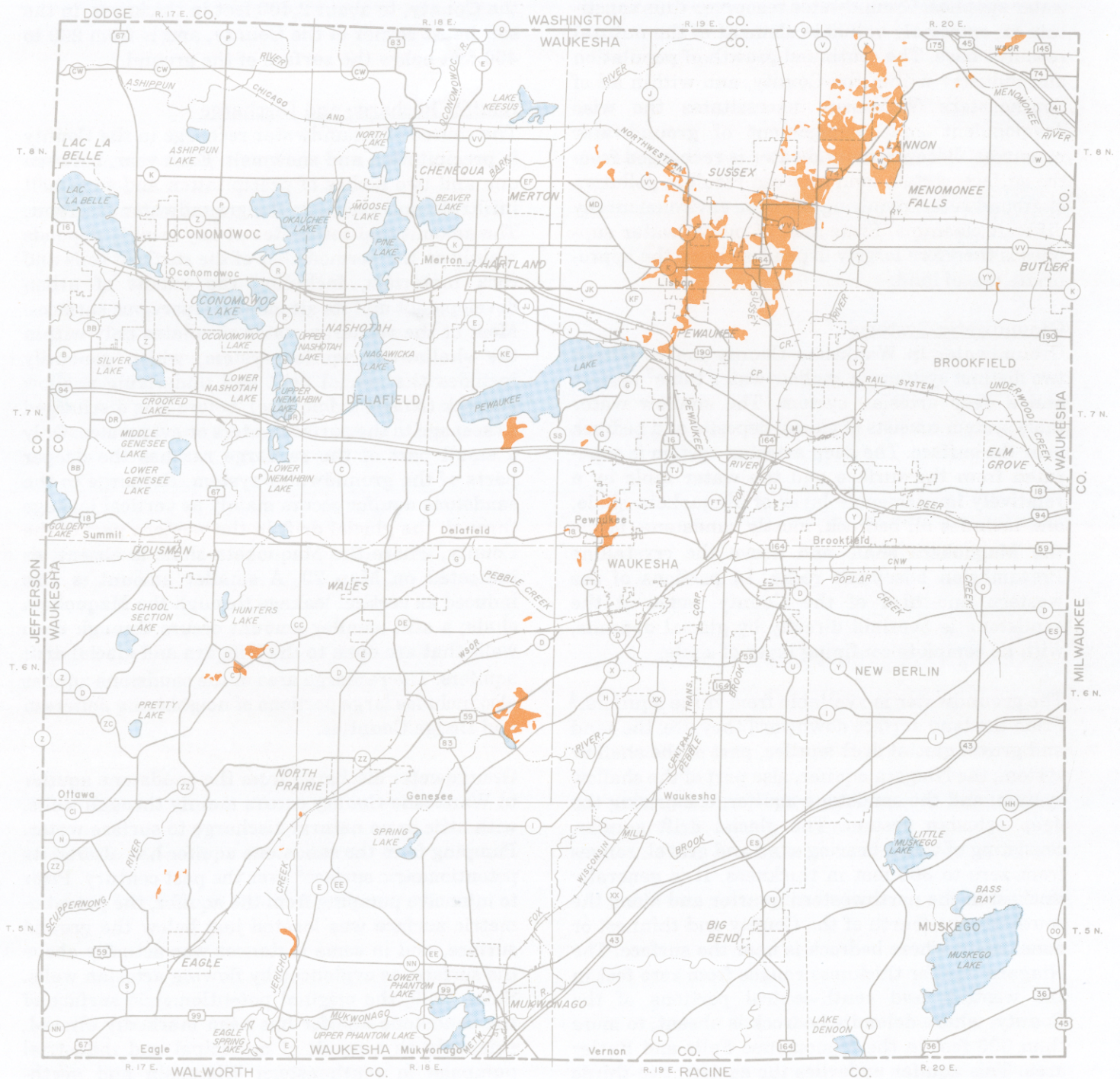


Source: U. S. Soil Conservation Service and SEWRPC.



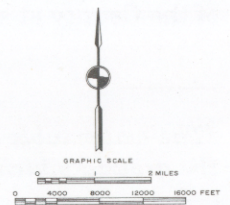
Map 19

AREAS WHERE SOIL SURVEY DATA INDICATE BEDROCK AT OR NEAR THE SURFACE IN WAUKESHA COUNTY



LEGEND

- AREA WHERE BEDROCK IS AT OR NEAR THE SURFACE
- SURFACE WATER



Source: U. S. Soil Conservation Service and SEWRPC.



sha County is entirely dependent on groundwater for its potable water supply and for many industrial water supplies. Groundwater resources thus constitute an extremely valuable element of the natural resource base. The continued growth of population and industry within the County, and within all of Southeastern Wisconsin, necessitates the wise development and management of groundwater resources. Because groundwater is recharged from the surface, certain land uses can result in pollution of groundwater, requiring costly or environmentally difficult cleanups. Protection of public water supplies is therefore largely dependent upon the appropriate use of land.

#### Groundwater Systems

Groundwater in Waukesha County moves within two distinct systems: a shallow water table<sup>3</sup> system and a deep artesian system. The shallow water table system consists of glacial deposits and bedrock near the surface. The deep artesian system is separated from the surface and the water table by a relatively impermeable layer of Maquoketa shale, and includes all bedrock, mostly sandstone, below the Maquoketa shale and above the crystalline Precambrian basement rocks. In portions of the western one-third of the County, some of the sandstone is overlaid directly by glacial deposits, with no complete confining layer of shale.

The groundwater is available from three aquifers.<sup>4</sup> From the land surface downward they are: the sand and gravel glacial drift aquifer, part of the shallow system; the Niagara aquifer, also part of the shallow system; and the sandstone aquifer, comprising the deep artesian system. The glacial drift aquifer, consisting of water-bearing sand and gravel, ranges from zero to 300 feet in thickness. It is generally thickest in the northwestern quarter and along the southern one-fourth of the County and thinnest or nonexistent where bedrock is near the surface. The Niagara aquifer thickness ranges from zero feet in the western and south-central portions of the County, where dolomite bedrock is absent, to more than 300 feet in the Menomonee Falls and Butler area. This aquifer underlies the eastern two-thirds of the County at shallow depths of approximately 50

feet or less. The sandstone (deep) aquifer ranges from about 400 feet thick, in the northwest corner of the County, to about 2,400 feet in thickness, in the southeast corner of the County, and is from 200 to 400 feet below the surface of the ground.

#### Aquifer Recharge and Discharge

The source of groundwater recharge in the County is precipitation and snowmelt. Each year, between one and two inches of precipitation and snowmelt infiltrate and recharge the groundwater reservoir. The amount that infiltrates at any locality depends mainly on the permeability of the surficial soils and rock materials, including the extent of urban development and its attendant impervious surfaces. Most of the recharge water circulates only within the shallowest aquifer system, which generally includes the glacial drift and underlying shallow bedrock (Niagara dolomite), before it is discharged as seepage to the surface waters or evaporates. Only a small part of the recharge reaches the deeper parts of the groundwater system. Recharge to the sandstone aquifer occurs mainly as vertical leakage through the glacial drift in the western part of the County, where the Maquoketa shale is absent, as indicated on Map 20. A smaller amount is also induced as vertical leakage through the Maquoketa shale; a still smaller amount occurs through deep wells that are open to the Niagara and glacial drift aquifers. The recharge area of the sandstone aquifer also includes large portions of neighboring Jefferson and Dodge Counties.

Groundwater discharge from the sandstone aquifer in Waukesha County occurs mainly through wells, with little or no natural discharge to surface water. Pumping from the sandstone aquifer has altered its potentiometric surface<sup>5</sup> over the past century. Prior to intensive pumping from the aquifer, the potentiometric surface was located just below the ground surface, and in some instances was actually above the surface, as evidenced by flowing artesian wells. Since 1880, the original potentiometric surface of the sandstone aquifer has been markedly altered, primarily as a result of municipal and industrial pumpage in southeastern Wisconsin and northeastern Illinois. Drawdowns of up to 350 feet have occurred in the Milwaukee-Waukesha area, while

<sup>3</sup>The water table is the upper limit of the portion of the ground which is fully saturated with water.

<sup>4</sup>An aquifer is a water-bearing stratum of rock, sand or gravel.

<sup>5</sup>The potentiometric surface represents the static head of water in an aquifer as defined by the levels to which water will rise in wells penetrating the aquifer.



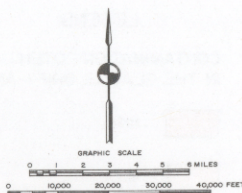
Map 20

# RECHARGE AREA OF THE SANDSTONE AQUIFER IN WAUKESHA COUNTY



## LEGEND

GROUND WATER RECHARGE AREAS FOR SANDSTONE AQUIFER



Source: SEWRPC.

drawdowns in excess of 275 feet have occurred at the Wisconsin-Illinois state line. The continued drawdown of the sandstone aquifer may be tempered by conversion to use of surface waters, particularly from Lake Michigan, by former heavy users of the sandstone aquifer in northeastern Illinois. Potential impacts of drawdown include higher pumping and construction costs for deeper wells.

## Groundwater Quality

Groundwater in the County is of good quality and is suitable for most uses, but most of the water is very hard and requires softening for some uses. Estimated well yields, or the quantity of water flowing per unit of time, are generally lowest in the Niagara aquifer and highest from the sandstone aquifer. The glacial drift aquifer generally yields water at half the rate of the sandstone aquifer. The largest users of groundwater in the County are its incorporated

municipalities, with most of the groundwater pumpage concentrated in the northeast quarter of the County and around the City of Waukesha. Large water users generally pump from the sandstone aquifer, while smaller and domestic users utilize the shallower Niagara and glacial drift aquifers.

## Vulnerability to Contamination

Groundwater quality conditions can be impacted by such sources of pollution on the surface as landfills, agricultural fertilizer, pesticides, manure storage and application sites, chemical spills, leaking surface or underground storage tanks, and onsite sewage disposal systems. The potential for groundwater pollution in the shallow water table aquifers is dependent on the depth to groundwater (see Map 21), the depth and type of soils through which precipitation must percolate, the location of groundwater recharge areas, and the subsurface geology. As shown on Map 22, most of Waukesha County exhibits moderate to high potential for contamination of groundwater in the shallow glacial drift and Niagara aquifers. Generally, the areas of the County most vulnerable to groundwater contamination are where both Niagara dolomite and the water table are near the surface.

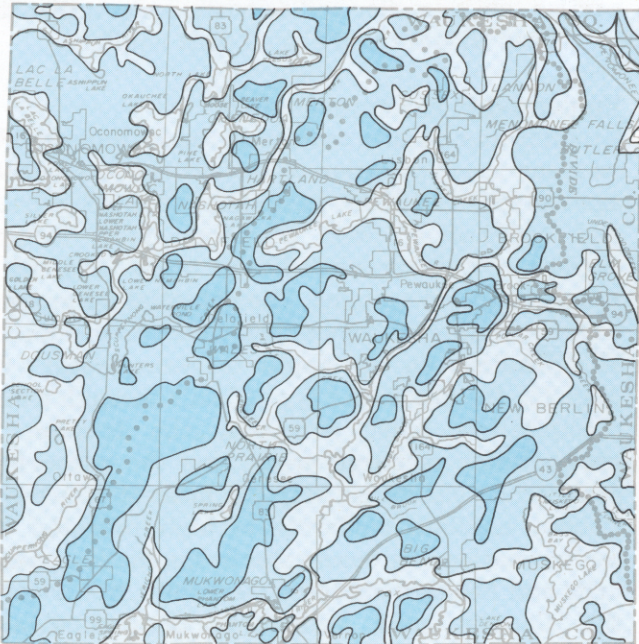
Compared to the deep aquifer, the shallow aquifers are more susceptible to pollution from the surface because they are nearer to the source in terms of both distance and time, thus minimizing the potential for dilution, filtration, and other natural processes that tend to reduce the potential detrimental effects of pollutants. Isolated cases of bacterial and nitrate contamination have been identified in portions of northeastern Waukesha County, where the dolomite formations are near the surface. Such problems can often be traced to nonpoint pollution sources and septic system discharges.

In parts of the western one-third of the County, there is no confining impermeable layer of rock between the glacial drift and the sandstone aquifer. This is cause for concern in planning for the future development of that area. Urban development adversely affects both the quantity and quality of recharge water, especially where the aquifer is overlaid by outwash, end moraine, or other highly permeable glacial material. An increase in the area of impervious surfaces such as pavement affects the recharge of the sandstone aquifer by diverting larger amounts of precipitation into surface drainage courses as runoff, rather than allowing it to percolate into the ground.



Map 21

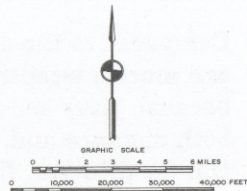
**DEPTH TO SEASONAL HIGH GROUNDWATER LEVELS IN WAUKESHA COUNTY**



**LEGEND**

DEPTH TO SEASONAL HIGH WATER

- GREATER THAN 30 FEET
- 10 - 30 FEET
- LESS THAN 10 FEET



Source: SEWRPC.

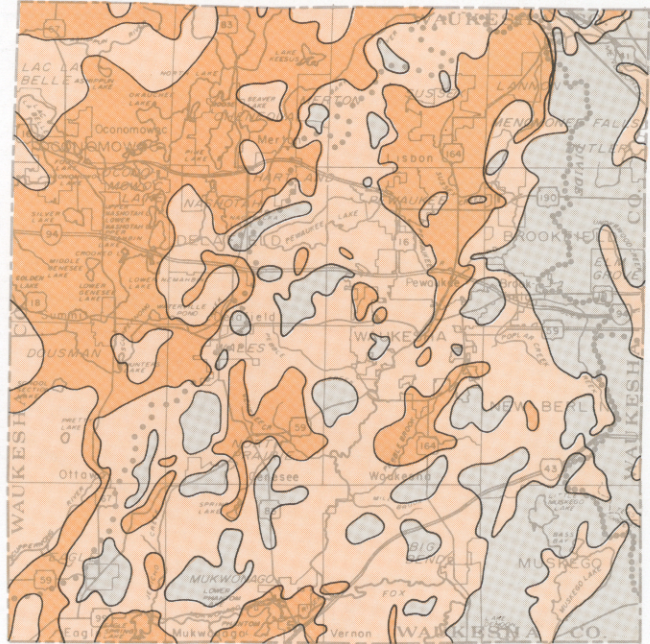
**Radium Concentrations**

Certain formations within the Cambrian sandstones in southeastern Wisconsin are known to produce relatively high concentrations of naturally occurring radium, a radioactive metallic element. This naturally occurring radium has been found to exceed U. S. EPA standards in approximately 50 of the 1,300 municipal water supplies in Wisconsin. Most of the water supplies which exceed the radium standard draw water from the deep sandstone aquifer and lie in a narrow band from the Illinois-Wisconsin border through Kenosha, Racine, and Waukesha Counties and north through Green Bay. Evaluations are being undertaken to consider means of reducing the radium level in these wells.

Systems serving the southern portion of the City of Brookfield, the City of New Berlin, the Village of Sussex, the Village of Mukwonago, the Village of

Map 22

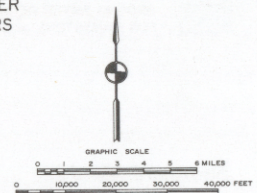
**POTENTIAL FOR GROUNDWATER CONTAMINATION IN WAUKESHA COUNTY**



**LEGEND**

CONTAMINATION POTENTIAL OF GROUNDWATER IN THE GLACIAL DRIFT AND NIAGRA AQUIFERS

- HIGH
- MODERATE
- LOW



Source: SEWRPC.

Eagle, and the City of Waukesha have reported some violations of the current five picocuries per liter Ra (pCi/l)<sup>6</sup> EPA standard for radium (combined <sup>226</sup>Ra and <sup>228</sup>Ra). The EPA is currently re-evaluating this standard and may eventually permit greater concentrations than are permitted under current rules. The standard could possibly be revised to 15 or 20 pCi/l, which may bring some of the current violators into conformance.

**SURFACE WATER RESOURCES**

Surface water resources constitute an extremely valuable part of the natural resource base of

<sup>6</sup>A unit of measure of radioactivity.